

(19) **DANMARK**

(10) **DK/EP 3374655 T3**



(12) **Oversættelse af
europæisk patentskrift**

Patent- og
Varemærkestyrelsen

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- (51) Int.Cl.: **F 16 D 55/226 (2006.01)** **F 16 D 65/092 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2023-02-06**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2023-01-11**
- (86) Europæisk ansøgning nr.: **16793911.5**
- (86) Europæisk indleveringsdag: **2016-11-10**
- (87) Den europæiske ansøgnings publiceringsdag: **2018-09-19**
- (86) International ansøgning nr.: **EP2016077261**
- (87) Internationalt publikationsnr.: **WO2017081147**
- (30) Prioritet: **2015-11-12 DE 102015119509**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
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- (54) Benævnelse: **Skivebremse og bremsebelægningssæt**
- (56) Fremdragne publikationer:
EP-A2- 0 268 095
WO-A1-99/50566
WO-A1-2016/171210
DE-A1- 2 211 013
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Disc Brake

The present invention relates to a disc brake according to the preamble of claim 1.

Such disc brakes are used in commercial vehicles in particular and are frequently actuated
5 pneumatically. The brake calliper of such disc brakes is designed as a sliding calliper and is
used in tight installation spaces, for example.

The brake calliper is usually connected via two bearing beams designed as fixed bearing and
floating bearing to the so-called adapter. In the adapter the brake pads are arranged on both
sides of a brake disc, displaceably guided and held under spring load by a pad retaining
10 bracket in pad shafts between so-called adapter horns in the adapter. The brake pads
frequently have a backing plate provided with a friction lining on one side.

In disc brakes, in particular in disc brakes with only one force introduction element,
construction-related irregular wear of the brake pads can occur. With respect to a plane of
their backing plates, the brake pads cannot wear in parallel both in the radial direction and in
15 the circumferential direction, which is described as radial or tangential wear.

Various solutions have been suggested for holding the brake pads in pad shafts, WO
2013/143993 A1 specifying an example for avoiding so-called residual drag torques.

US 8,540,061 B1 describes a brake pad retaining system.

DE 10 2012 002 734 A1 specifies a pad retaining system for avoiding a rotation of the brake
20 pads during a braking process.

WO 99/50566A1 relates to a disc brake with an adapter attached to a housing. The adapter
has an asymmetric first and second rail. The first rail has a first and a second section, each of
which has a bounding surface separated from a first locating surface. The second rail has first
and second sections, each of which has an alignment or holding surface separated from a
25 second locating surface. Brake pad supports of the first and the second brake pad have a first
projection, which only touches the boundary surface of the first rail, and a second projection,
which only touches the second locating surface of the second rail. A spring 88 engages with
the first and the second brake pad support to maintain the tangent contact line with the second
locating surface. The inclination of the locating surfaces is chosen in such a way that the

braking force is transmitted into the adapter by the first and the second brake pad support during a braking process. The spring 88 engages with sections of each brake pad support in order to press the second projections 68 of said brake pad supports 62, 62' into the respective tangent contact line with second locating surfaces in the second rail (claim 13). The spring 88 comprises a loop section 86 located at ears 70, 70' at the respective brake pad support 62, 62' and a hook section 89, the hook section 89 being attached to the adapter in order to maintain a continuous force for maintaining the tangent contact line between the second projections 68 and the locating surfaces 54, 54' (claim 12). As can be seen clearly in Figs. 1, 4 and 8, only one spring 88 is provided on one side (in Figs. 1, 4, 8 on the left-hand side of the brake pad supports) and is only in one-sided engagement with a brake pad support each. The spring 88 is clearly designed as a compression spring.

In the background of these solutions there is furthermore a consistent need for a longer service life of brake pads and thus of brakes and brake components, combined with cost reduction.

The invention is therefore based on the problem of creating an improved disc brake with a longer brake pad service life.

The invention solves this problem by the subject matter of claim 1.

According to this a disc brake for a vehicle, in particular a commercial vehicle, comprises a brake disc with a brake disc axis of rotation, at least one application-side and one rear-side brake disc with a backing plate each, an adapter accommodating the at least two brake pads in a respective pad shaft between a leading edge-side and a trailing edge-side adapter horn and a bridge section, wherein one of the at least two brake pads is held in the associated pad shaft in positive-locking holder to at least one of the adapter horns in the radial direction with respect to the brake disc axis of rotation and spring-loaded with a preloading force pressing the one of the at least two brake pads away from the bridge section of the adapter in the radial direction with respect to the brake disc axis of rotation against the positive-locking holder of the at least one adapter horn, and a brake calliper overlapping the brake disc. At the leading edge-side adapter horn and the trailing edge-side adapter horn a positive-locking holder of at least the application-side brake pad in the pad shaft is provided, wherein the positive-locking holder forms an oblique wear compensation device with noses with undercuts, projections of the backing plate and the preloading force.

It has surprisingly been found that a positive-locking holder of at least the application-side brake pad at both adapter horns together with a preloading force forms an oblique wear compensation device. Calculation results show, against prior art, a more even contact pressure for the brake pad, due to the positive-locking holder including the preloading force.

5 This advantageously reduces radial or tangential wear considerably, as could be substantiated by the calculations.

The preloading force can be generated by springs, for example, which are designed as compression springs and located below the brake pad, being supported at the pad shaft, i.e. the stationary adapter.

10 It is advantageous if the application-side brake pad bears in the non-operated state of the disc brake with a top side of each projection against an underside of each nose under the application of the preloading force. This is advantageous, because in this way forces are immediately generated in a braking process without bridging a clearance, which forces influence the brake pad, e.g. by generating advantageous torques, in such a way that a radial
15 or tangential wear is reduced. In addition noise generation is reduced as well.

In one variant the noses of the positive-locking holders project from one each of the adapter horns into the pad shaft. In this way they can easily interact with the projections of the backing plate, enabling the brake pad to be installed into the pad shaft parallel to the direction of the brake disc axis of rotation.

20 For this purpose it is provided that each of the projections of the application-side backing plate of the application-side brake pad projects outwards from a respective side of the application-side backing plate, wherein recesses for accommodating the noses are formed thereabove into the backing plate, in each case from the side.

In one variant the underside of each nose and the respectively associated top side of each
25 projection extend at an angle obliquely to a line of action of a braking force, wherein the line of action of the braking force extends parallel to surfaces of support sections of the bridge section of the adapter, said support sections forming a bottom support of the application-side pad shaft. This configuration offers the advantage that, at the forces acting on the brake pad in this process, the whole surface of the backing plate comes with its trailing edge-side into
30 contact with the trailing edge-side adapter horn. In addition the static friction between the oblique surfaces of the underside of the leading edge-side nose and the top side of the leading

edge-side projection is exceeded, resulting in a relative movement between said underside and said top side. In this way an overload is advantageously prevented. In addition there is the advantage that the brake pad cannot seize up in the pad shaft, e.g. by corrosion, thanks to this relative movement.

5 A further variant provides that the leading edge-side nose and the associated top side of the leading edge-side projection are formed mirror-inversely to the trailing edge-side nose and the associated top side of the trailing edge-side projection. This provides a symmetric arrangement of the positive-locking holders.

10 In a yet further variant the undersides – formed obliquely at the angle – of the noses and the respectively associated top sides of the projections are arranged in such a way that they are inclined towards the brake disc axis of rotation. This provides a compact construction.

In one variant the value of the angle lies in a range of 10° ... 20° , preferably 12° ... 17° . In this way a self-retention or the static friction can be influenced with respect to the relative movement between nose and projection.

15 In a preferred variant the disc brake furthermore has a pad retaining bracket releasably attached to the brake calliper to hold the rear-side brake pad in the adapter under spring load. In this it is especially preferably provided that the application-side brake pad with its backing plate is connected to an application-side anti-rattle spring which is attached to the pad retaining bracket and the application-side brake pad in such a way that the application-side
20 anti-rattle spring applies a tensile force to the application-side brake pad and generates the preloading force. This saves additional components for generating the preloading force.

In this it is provided that the pad retaining bracket extends between an underside of the application-side anti-rattle spring and a top side of the application-side backing plate, the application-side anti-rattle spring lying on a top side of the pad retaining bracket. This
25 provides a simple assembly and a compact structure.

The application-side anti-rattle spring pulls the application-side brake pad against the positive-locking holder in the adapter and can also reduce vibration-related deflections of the brake calliper in the radial direction away from the brake disc axis of rotation.

The rear-side anti-rattle spring can furthermore reduce vibrations of the brake calliper
30 towards the centre of the axle.

In an alternative variant the application-side anti-rattle spring is mounted on an underside of the pad retaining bracket. In addition a tensile force for generating the preloading force can advantageously be generated by the application-side anti-rattle spring.

A brake pad set for the disc brake described above comprises the two brake pads on the
5 respective backing plate, associated anti-rattle springs and the pad retaining bracket. This provides an advantageously simple and fast assembly in maintenance and repair operations.

In the drawings embodiments of a disc brake according to the invention and a brake pad set according to the invention are illustrated and are described in greater detail below, wherein
10 further advantages of variants according to the invention are explained as well. In the drawing:

Fig. 1 is a diagrammatic part-sectional view of an embodiment of a disc brake according to the invention with an oblique wear compensation device;

Figs. 2 to 4 are diagrammatic part-sectional views of the disc brake according to the invention;

15 Fig. 5 is an enlarged diagrammatic view of a brake pad retainer; and

Fig. 6 is a diagrammatic perspective view of a variant of the embodiment of the disc brake according to the invention.

Terms like “top/upper”, “bottom/lower”, “right-hand”, “left-hand” etc. relate to orientations and arrangements in the figures. Coordinates x, y, z in the figures are provided for further
20 orientation.

Fig. 1 is a diagrammatic part-sectional view of an embodiment of a disc brake 1 according to the invention, for example a pneumatic disc brake 1, with an oblique wear compensation device.

The disc brake 1 is a part of the brake system of a vehicle, in particular a commercial vehicle,
25 for example, and comprises a brake disc 2 with a brake disc axis of rotation 2a, which here extends in y-direction, two brake pads 3 and 4, each mounted on a backing plate 3a, 4a, an adapter 5, a brake calliper 6 and an application device 9.

Each of the brake pads 3 and 4 with their backing plates 3a, 4a is accommodated in the adapter 5 in a pad shaft 10, 10a between two adapter horns 11, 11'; 12, 12' each and held in

the adapter 5 by a pad retaining bracket 15. The brake pads 3 and 4 are displaceably guided in the pad shafts 10, 10a in the direction of the brake disc axis of rotation 2a.

It is assumed here that the brake disc 2 rotates about its brake disc axis of rotation 2a in such a way during a forward travel of the associated vehicle that the associated vehicle moves in positive x-direction. This being so, the side of the brake calliper 6 which is at the bottom in Figure 1 is denoted as leading edge-side EL and the opposite top side of the brake calliper 6 is denoted as trailing-edge side AL.

With respect to their assignment to the leading edge-side EL and to the trailing-edge side AL, identical components and assemblies are differentiated below by providing the components and assemblies assigned to the trailing-edge side AL with an apostrophe.

Accordingly the adapter horns 11, 12 are denoted as leading edge-side adapter horns 11, 12 and the opposite adapter horns 11', 12' are denoted as trailing edge-side adapter horns 11', 12'.

The brake calliper 6 is here designed as a sliding calliper 6 and has an application section 6a and a rear section 6b, which is also denoted as reaction section. The application section 6a and the rear section 6b are connected to each other at both ends via connecting sections 6c, 6'c in y-direction. In this the application section 6a and the rear section 6b are each located on one side of the brake disc 2 parallel thereto, the connecting sections 6c, 6'c extending in y-direction parallel to the brake disc axis of rotation 2a. The application section 6a and the rear section 6b together with the connecting sections 6c, 6'c form an opening above the brake disc 2 with the brake pads 3 and 4 for access thereto in assembly, replacement and maintenance operations.

The brake calliper 6 is held at the fixed adapter 5 for guided displacement in the direction of the brake disc axis of rotation 2a by means of bearings 7, 8. The bearings 7, 8 are not explained in detail here.

The application section 6a of the brake calliper 6 accommodates the application device 9 of the disc brake 1. The application device 9 is used to actuate the disc brake 1 and can have a brake rotary lever with a pneumatic cylinder, for example. The application device 9 shown here by way of example is a so-called twin-plunger application device 9 with a plunger 9a, 9'a each. Each plunger 9a, 9'a is in contact with a rear side 3b of the application side backing plate 3a. The application device 9 is not explained in detail here.

The side of the disc brake 1 where the application section 6a of the brake calliper 6 with the application device 9 is located is denoted as application side ZS below. The other side of the disc brake 1, where the rear section 6b of the brake calliper 6 is located, is denoted as rear side RS or reaction side in the following description. The terms “application side” and “rear side” and further related terms are in common use and provide better orientation.

The brake pad 3 with the backing plate 3a located on the application side ZS is therefore denoted as application-side brake pad 3, and the opposite brake pad is denoted as rear-side brake pad 4 with the backing plate 4a.

The application-side brake pad 3 is subjected to an application force in y-direction by the application device 9 during braking processes. The rear-side brake pad 4 is accommodated in the rear section 6b of the brake calliper 6 and has in this disc brake 1 with the brake calliper 6 designed as a sliding calliper no relative movements towards the rear section 6b. A rear side 4b of the rear-side backing plate 4a is in contact with the rear section 6b of the brake calliper 6.

In disc brakes construction-related irregular wear of the brake pads 3, 4 can occur. With respect to the plane of the respective backing plate 3a, 4a, the brake pads 3, 4 cannot wear in parallel both in the radial direction (z-direction) and in the circumferential direction. These kinds of wear are called radial and tangential wear respectively. The oblique wear compensation device described in detail below compensates for such oblique wear.

For this purpose Figs. 2 to 4 are diagrammatic part-sectional views of the disc brake 1 according to the invention.

Figs. 2 and 3 are top views of the disc brake 1. The disc brake 1 is here designed as a single-plunger disc brake 1. The application device 9 therefore has only one plunger 9^a with an associated pressure piece 9^b.

The above-mentioned oblique wear can in particular occur in such single-plunger disc brakes.

An application force F_z is generated by the application device 9 and introduced into the application-side brake pad 3 by the plunger 9^a via the pressure piece 9^b, which is in contact with the rear side 3b of the backing plate 3a of the application-side brake pad 3. The brake disc 2 rotates in a main direction of rotation HDR. As the brake disc 2 rotates, the introduced

application force F_Z generates a braking force F_B in accordance with the following physical law:

$$F_B = \mu B * F_Z \quad (1)$$

In this μB is the friction coefficient between the brake disc 2 and the friction material of the application-side brake pad 3.

The braking force F_B extends tangentially to the brake disc 2, a line of action of the braking force F_B extending parallel to surfaces of support sections 26 (see Fig. 6) of end sections of a bridge section 5a of the adapter 5, which are designed as carrying sections 5b, 5'b. The support sections 26 form a lower support for the application-side pad shaft 10.

The braking force F_B is supported at the adapter 5 at a point P. This point P is located on the inside of the pad shaft 10 of the trailing edge-side adapter horn 11'. Here the application-side brake pad 3 bears against the trailing edge-side adapter horn 11' with its backing plate 3a.

The point P lies in negative y-direction, offset against the line of action of the braking force F_B , at a distance which is here denoted as lever length a. This offset of the line of action of the braking force F_B against the support point P produces a momentum as follows:

$$M_S = F_B * a \quad (2)$$

This momentum M_S now results in an uneven force distribution at the surface of the application-side brake pad 3. This uneven force distribution is superimposed on the application force F_Z and leads to a tangential wear on the leading edge side of the application-side brake pad 3.

In order to achieve at least a compensation of the moment M_S to some degree, an opposing compensation moment M_K is now generated. This can be viewed in Fig. 3.

The compensation moment M_K results from the generation of a compensation force F_K on the leading edge side of the brake pad 3. With a lever arm I corresponding to a distance between the two insides of the pad shaft 10, the resulting compensation moment M_K is

$$M_K = F_K * I \quad (3)$$

A complete compensation is provided in the following condition:

$$M_K = M_S \quad (4)$$

$$F_K * I = F_B * a \quad (4a)$$

The compensation force F_K is generated as can be gathered from US 8,540,061 B1, for example.

5 Figs. 4 and 5 are vies of the rear side 3b of the backing plate 3a of the application-side brake pad 3 in the application-side pad shaft 10 as viewed from the application side. In Fig 6 a diagrammatic enlarged view of a section of the brake pad holder is presented.

The adapter 5 has a bridge section 5a, which connects the leading-edge side adapter horn 11 and the trailing edge-side adapter horn 11' and extends in x-direction. The leading-edge side adapter horn 12 and the trailing edge-side adapter horn 12' on the rear side RS are connected
10 in the same way by a further bridge section of the adapter 5, which is not shown here but can easily be imagined.

The leading-edge side adapter horn 11 and the trailing edge-side adapter horn 11' form with their insides and with end sections of the bridge section 5a designed as carrying sections 5b, 5'b the application-side pad shaft 10.

15 On the inside of the leading edge-side adapter horn 11, in its lower half, a leading edge-side nose 20 is formed, which projects from the leading edge-side adapter horn 11 into the pad shaft 10. Below the nose 20 an undercut 27 is located between an underside 24 of the nose 20 and the leading edge-side carrying section 5b of the adapter 5.

20 This arrangement is provided at the trailing edge-side adapter horn 11' as well in mirror fashion. Here a trailing edge-side nose 20' likewise projects into the pad shaft 10. Below the trailing edge-side nose 20' the undercut 27' is provided as well.

Each side of the application-side backing plate 3a is designed such that it communicates with the profile of an associated inside of an adapter horn 11, 11'. The application-side brake pad 3 is installed into the pad shaft 10 with its backing plate 3a in y-direction in such a way that
25 the projections 30, 30' are accommodated in the undercuts 27, 27' of the adapter horns 11, 11' and the noses 20, 20' are located in recesses 40 of the backing plate 3a.

The noses 20, 20' of the adapter horns 11, 11' and the projections 30, 30' of the application-side backing plate 3a of the application-side brake pad 3 in each case form a positive-locking holder of the application-side brake pad 3 in the pad shaft 10.

The profile of the inside of the leading edge-side adapter horn 11 and the profile of the associated outside of the application-side backing plate 3a are shown enlarged in Fig. 6.

The inside of the leading edge-side adapter horn 11 extends from an upper end initially along approximately the half length in a straight wall section 21 in negative z-direction and then
5 merges into the nose 20 with a transition section 22. The nose 20 projects into the pad shaft 10 and has a straight sloping nose section 23 extending downwards at an angle. At the lower end of the nose section 23, a straight section extending outwards and towards the top at an angle is provided as underside 24 of the nose 20. This underside 24 extends at an angle α to the line of action of the braking force F_B (see Fig. 5) and merges at its rear end in the leading
10 edge-side adapter horn 11 by way of a curvature into a straight wall section 25 extending in negative z-direction. Like the surface of the upper wall section 21, the surface of the wall section 25 extends in a y-z-plane, the surface of the lower wall section 25 being offset relative to the surface of the upper wall section 21 in negative x-direction. At its lower end the lower wall section 25 merges via a curvature into a support section 26 located on the
15 carrying section 5b of the adapter 5. The support section 26 lies in an x-y-plane.

The undercut 27 comprises the underside 24 of the nose 20 and the lower wall section 25.

The outside of the application-side backing plate 3a of the application-side brake pad 3, which substantially corresponds to said profile, starts with a straight contact section 31 extending in negative z-direction and then merging with a transition section 32 into a recess
20 section 33 of a recess 40 extending downwards at an angle and in the direction towards the centre of the application-side backing plate 3a. The lower end of the recess section 33 is joined to a curved transition section 34, the lower end of which merges into a straight section with a top side 35. This straight section extends outwards and towards the top at the same angle α as the underside 24 of the nose 20 and merges at its upper end into a projection
25 section 36 extending downwards in negative z-direction. The lower end of the projection section 36 merges at a right angle – pointing towards the centre of the backing plate (in positive x-direction) – into a straight support section 37, the transition having a chamfer. The support section 37 corresponds to the support section 26 of the carrying section 5b.

In this way the undersides 24 of the noses 20, 20' designed with the angle α and the
30 respectively associated top sides 35 of the projections 30, 30' are arranged in such a way that they are inclined towards the brake disc axis of rotation 2a.

The top side 35, the projection section 36 and the support section 37 surround the leading edge-side projection 30 of the application-side backing plate 3a.

The nose 20 is accommodated in the recess 40 of the backing plate 3a.

5 The top side 35 of the projection 30 and the underside 24 of the nose 20 touch each other at the contact point D.

The profile arrangement inversely applies to the trailing edge side as well, which is not described here, but understood.

10 In this arrangement, in which the application-side brake pad is installed into the application-side pad shaft 10 in this way, the compensation force F_K is generated by a force F_L pressing the leading edge-side projection 30 of the application-side backing plate 3a in z-direction against the leading edge-side nose 20 of the leading edge-side adapter horn 11.

The compensation force F_K results from the force F_L in accordance with the following correlation:

$$F_K = \mu * F_L \quad (5)$$

15 In this μ is the friction coefficient between the projection 30 of the application-side backing plate 3a and the nose 20 of the leading edge-side adapter horn 11.

20 In this the force F_L depends on a supporting length approximately corresponding to the lever arm I and on a distance b of a pressure or contact point B at the trailing edge-side adapter horn 11'. The pressure point B lies in the distance or the lever length b between the line of action of the braking force F_B and a contact point between the trailing edge-side projection 30' of the application-side backing plate 3a and the trailing edge-side adapter horn 11'. The projections 30 and 30' will be explained in detail below in the context of the noses 20, 20'.

The following condition applies to the obtainable force F_L :

$$F_L * I = F_B * b \quad (6)$$

25 The obtainable compensation force F_L is therefore proportional to the lever length b of the contact point B from the centre of the braking force F_B . The lever length b cannot be increased arbitrarily, however, so that the obtainable force F_L is limited.

In Fig. 5 the hold or arrangement of the application-side brake pad 3 in the application-side pad shaft 10 of the oblique wear compensation device is illustrated. The oblique wear compensation device comprises the holder of the application-side brake pad 3 in the application-side pad shaft 10 between the leading edge-side adapter horn 11 and the trailing edge-side adapter horn 11' with the noses 20, 20', the undercuts 25, 25', the projections 30, 30' and a preloading force F_V in positive z-direction.

The noses 20, 20' with their undercuts 25, 25' are designed such that their undersides 24 extend at an angle α to the line of action of the braking force F_B . The value of the angle α lies in a range of $10^\circ \dots 20^\circ$, being preferably 15° .

10 The top sides 35 of the projections 30, 30' have the same angle α .

In the non-actuated state of the disc brake 1, the application-side brake pad 3 bears with each projections 30, 30' against an underside 24 of the noses 20, 20' by virtue of the corresponding preloading force F_V , resulting in a contact of the underside of the leading edge-side nose 20 and the top side 35 of the leading edge-side projection 30 at a contact point D

15 The preloading force F_V can be applied to the application-side brake pad 3 by at least one spring, for example. The preloading force F_V can be generated in various ways. Examples for this can be found in DE 10 2012 002 734 A1. A further way of generating the preloading force F_V will be described in greater detail below.

20 The application-side brake pad 3 is therefore spring-loaded, wherein the generated preloading force F_V presses the application-side brake pad 3 away from the bridge section 5a of the adapter 5 in the radial direction with respect to the brake disc axis of rotation 2a against the positive-locking holder of the adapter horns 11, 11'.

25 If a braking force F_B is introduced into this preloaded arrangement of the application-side brake pad 3, the application-side brake pad 3 is supported at the undercut 25 at the contact point D by way of the leading edge-side projection 30 of its backing plate 3a at the leading edge-side nose 20 of the leading edge-side adapter horn 11 of the adapter 5 and generates a force F_{L2} .

By a rotary movement about the contact point D with a lever d, the application-side backing plate 3a with the brake pad 3 also comes into point contact at the trailing edge-side adapter

horn 11' on the inside thereof at a contact point C in the outer region. The lever arm d is the distance of the contact point D at right angles to the line of action of the braking force F_B .

There now arises a torque about the contact point C with a lever arm c extending at right angles to the line of action of the braking force F_B and through the contact point C. This torque brings the whole surface of the side of the application-side adapter plate 3a of the application-side brake pad 3 into contact with the inside of the trailing edge-side adapter horn 11'.

In this the force increases at the contact point D until the top side 35 of the leading edge-side projection 30 of the application-side backing plate 3a has exceeded the static friction with the underside 24 of the leading edge-side nose 20 at the leading edge-side adapter horn 11 and slides along the underside 24 of the nose 20, which extends at the angle α . This prevents an overload. The application-side brake pad 3 therefore cannot seize up, e.g. because of corrosion, in the pad shaft 10 with its backing plate 3a as a result of its movement.

The braking force F_B is now divided into two component forces F_{BE} and F_{BD} , which act as resultant forces at the points D and E. The point E lies in the point of intersection of the line of action of the braking force F_B and the inside of the trailing edge-side adapter horn 11'.

$$F_B = F_{BE} + F_{BD} \quad (7)$$

The force F_{L2} is now independent of lever conditions and proportional to the braking force F_B .

$$F_{L2} = F_{BE} / \sin \alpha \quad (7)$$

Results of extensive calculations have shown that the design of the nose 20 makes for an improved, more even contact pressure for the application-side brake pad 3. In this the underside of the leading edge-side nose 20 – extending at the angle α – with the undercut 25 is a measure that additionally increases this effect of the more even contact pressure.

Fig. 7 finally is a diagrammatic perspective view of a variant of the embodiment of the disc brake 1 according to the invention.

For an overall view the brake disc 2 is not shown in Fig. 7, but can easily be imagined.

Each of the brake pads 3 and 4 is on the top side of its respective backing plate 3a, 4a provided with an anti-rattle spring 13, 14 hinged to spring holders at the respective backing plate 3a, 4a. The anti-rattle springs 13, 14 interact with the pad retaining bracket 15.

The pad retaining bracket 15 extends in y-direction above the opening formed by the application section 6a, the rear section 6b and the connecting sections 6c above the brake disc 2 and is arranged above the installed brake pads 3, 4 in such a way that it is accommodated with an application-side end section 15a in a holding section 6d of the application section 6a of the brake calliper 6, wherein an opposite end section 15b of the pad retaining bracket 15 is connected to a holding section 6e of the rear section 6b of the brake calliper 6. This rear end section 15a of the pad retaining bracket 15 is secured in its position by a securing element, e.g. a bolt.

In this embodiment the pad retaining bracket 15 is arranged above the brake pads 3, 4 in such a way that it extends between an underside of the application-side anti-rattle spring 13 of the application-side brake pad 3 and a top side of the application-side backing plate 3a. In other words, the application-side anti-rattle spring 13 lies on a top side of the pad retaining bracket 15. In this the anti-rattle spring 13 applies a tensile force in z-direction radial to the brake disc axis of rotation 2a to the application-side backing plate 3a and the application-side brake pad 3. The spring holders (not shown, but easily imagined) are suitably designed for this. The tensile force generated by the application-side anti-rattle spring 13 represents the preloading force F_V described above.

In the region of the rear-side brake pad 4, the pad retaining bracket 15 is with an underside in contact with the rear-side anti-rattle spring 14 of the rear-side backing plate 4a. In this the pad retaining bracket 15 applies a compressive force to the rear-side anti-rattle spring 14, which is transmitted to the rear-side backing plate 4a and the rear-side brake pad 4. The rear-side brake pad 4 introduces this compressive force, which acts in the radial direction, i.e. in negative z-direction, with respect to the brake disc axis of rotation 2a, into the adapter 5 via the rear-side backing plate 4a.

The reference symbol 100 denotes a brake pad set comprising the two brake pads 3, 4 on the respective backing plate 3a, 4a, the associated anti-rattle springs 13, 14 and the pad retaining bracket 15.

The brake pad set 100 can be used in all disc brakes 1 with a sliding calliper, in particular for commercial vehicles.

The invention is not restricted to the embodiments described above, but can be modified in the context of the appended claims.

- 5 It is for example conceivable that the application-side ant-rattle spring 13 is suitably attached to the underside of the pad retaining bracket 15 in such a way that it generates the preloading force F_V for the application-side brake pad 3.

List for Reference Symbols

	1	Disc brake
	2	Brake disc
	2a	Brake disc axis of rotation
5	3, 4	Brake pad
	3a, 4a	Backing plate
	3b, 4b	Rear side
	5	Adapter
	5a	Bridge section
10	5b, 5b'	Carrying section
	6	Brake calliper
	6a	Application section
	6b	Rear section
	6c	Connecting section
15	6d, 6e	Holding section
	7, 8	Bearing
	9	Application device
	9a, 9'a, 9''a	Plunger
	9b, 9'b, 9''b	Pressure piece
20	10, 10a	Pad shaft
	11, 11'; 12, 12'	Adapter horn
	13, 14	Anti-rattle spring
	15	Pad retaining bracket
	15a, 15b	End section
25	20, 20'	Nose
	21	Wall section
	22	Transition section

	23	Nose section
	24	Underside
	25, 25'	Wall section
	26	Support section
5	27	Undercut
	30, 30'	Projection
	31	Contact section
	32, 34	Transition section
	33	Recess section
10	35	Top side
	36	Projection section
	37	Support section
	40, 40'	Recess
	100	Brake pad set
15	α	Angle
	a, b, c, d, I	Lever length
	AL	Trailing edge side
	EL	Leading edge side
	$F_B, F_{BD}, F_{BE}, F_K, F_L, F_{L2}, F_V, F_Z$	Force
20	HDR	Main direction of rotation
	M_K, M_S	Momentum
	RS	Rear side
	ZS	Application side
	x, y, z	Coordinates

Patentkrav

1. Skivebremse (1) til et køretøj, især til et erhvervskøretøj, omfattende en
bremseskive (2) med en bremseskiverotationsakse (2a), mindst en bremsebe-
lægning på tilspændingssiden og en bremsebelægning (3, 4) på bagsiden med
5 en pågældende belægningsbærerplade (3a, 4a), en bremsebærer (5), der op-
tager de mindst to bremsebelægninger (3, 4) i en pågældende belægnings-
skakt (10, 10a) mellem et bremsebærerhorn (11, 11'; 12, 12') på indløbssiden
og et på udløbssiden og et broafsnit (5a), hvor en af de mindst to bremsebe-
lægninger (3, 4) holdes i den tilhørende belægnings-skakt (10, 10a) med mindst
10 et af bremsebærerhornene (11, 11'; 12, 12') i formssluttende fastholdelse i ra-
dial retning i forhold til bremseskiverotationsaksen (2a) og påvirkes fjederbe-
lastet med en forspændingskraft (Fv), der presser den ene af de mindst to
bremsebelægninger (3, 4) væk fra bremsebærerens (5) broafsnit (5a) i radial
15 retning i forhold til bremseskiverotationsaksen (2a) mod den formssluttende
fastholdelse af det mindst ene bremsebærerhorn (11, 11'; 12, 12'), og en brem-
sesaddel (6), der griber over bremseskiven (2), hvor der på bremsebærerhor-
net (11) på indløbssiden og på bremsebærerhornet (11') på udløbssiden i hvert
tilfælde er tilvejebragt en formssluttende fastholdelse af mindst bremsebelæg-
20 ningen (3) på tilspændingssiden i belægnings-skakten (10), hvor den formslut-
tende fastholdelse med næser (20, 20') med underskæringer (27, 27'), frem-
spring (30, 30') af belægningsbærerpladen (3a) af bremsebelægningen (3) på
tilspændingssiden og forspændingskraften (Fv) danner en kompenseringsind-
retning for skråt slid,
25 hvor skivebremsen (1) endvidere har en belægningsholdebøjle (15), der er fri-
gørligt fastgjort på bremsesadlen (6) og som bremsebelægningen (3) på bag-
siden holdes fjederbelastet af i bremsebæreren (5),
kendetegnet ved, at bremsebelægningen (3) på tilspændingssiden med be-
lægningsbærepladen (3a) er forbundet med en belægningsholdefjeder (13) på
30 tilspændingssiden, der er anbragt på belægningsholdebøjlen (15) og bremse-
belægningen (3) på tilspændingssiden på en sådan måde, at belægningshol-
defjederen (13) på tilspændingssiden udøver en trækraft på bremsebelæg-
ningen (3) på tilspændingssiden og genererer forspændingskraften (Fv).

5 2. Skivebremse (1) ifølge krav 1, **kendetegnet ved, at** bremsebelægningen (3) på tilspændingssiden i skivebremsens (1) ikke betjente tilstand med en overside (35) af hvert fremspring (30, 30') i hvert tilfælde ligger an mod en underside (24) af hver næse (20, 20') under påvirkning af forspændingskraften (Fv).

10 3. Skivebremse (1) ifølge krav 2, **kendetegnet ved, at** næserne (20, 20') af de formluttende fastholdelser rager ind i belægningskakten (10) fra hver især et af bremsebærerhornene (11, 11').

15 4. Skivebremse (1) ifølge krav 3, **kendetegnet ved, at** fremspringene (30, 30') af den tilspændingssidige bremsebelægnings (3) belægningsbærerplade (3a) på tilspændingssiden hver især rager udad fra en pågældende side af belægningsbærerpladen (3a) på tilspændingssiden, hvor der derover er udformet udsparinger (40, 40') til optagelse af næserne (20, 20') i belægningsbærerpladen (3a) i hvert tilfælde fra siden.

20 5. Skivebremse (1) ifølge krav 4, **kendetegnet ved, at** undersiden (24) af hver næse (20, 20') og den i hvert tilfælde tilhørende overside (35) af hvert fremspring (30, 30') forløber i en vinkel (α) skråt i forhold til en funktionslinje af en bremsekraft (F_B), hvor bremsekraftens (F_B) funktionslinje forløber parallelt med flader af støtteafsnit (26) af bremsebærerens (5) broafsnit (5a), hvor disse støtteafsnit (26) danner et nedre underlag af belægningskakten (10) på tilspændingssiden.

25 6. Skivebremse (1) ifølge krav 5, **kendetegnet ved, at** næsen (20) på indløbs-siden og den tilhørende overside (35) af fremspringet (30) på indløbssiden er udformet spejlvendt i forhold til næsen (20) på udløbssiden og den tilhørende overside af fremspringet (30') på udløbssiden.

30 7. Skivebremse (1) ifølge krav 6, **kendetegnet ved, at** næsernes (20, 20') undersider (24), der er udformet skråt i vinklen (α), og de hver især tilhørende oversider (35) af fremspringene (30, 30') er anbragt på en sådan måde, at de hælder mod bremseskiverotationsaksen (2a).

35

8. Skivebremse (1) ifølge et af kravene 5 til 7, **kendetegnet ved, at** vinklens (α) værdi ligger i et område fra 10° ... 20° , fortrinsvis 12° ... 17° .
- 5 9. Skivebremse (1) ifølge et af de foregående krav, **kendetegnet ved, at** belægningsholdebøjlen (15) strækker sig mellem en underside af belægningsholdefjederen (13) på tilspændingssiden og en overside af belægningsbæreladen (3a) på tilspændingssiden, hvor belægningsholdefjederen (13) på tilspændingssiden ligger på en overside af belægningsholdebøjlen (15).
- 10 10. Skivebremse (1) ifølge et af kravene 1 til 8, **kendetegnet ved, at** belægningsholdefjederen (13) på tilspændingssiden er anbragt på en underside af belægningsholdebøjlen (15).

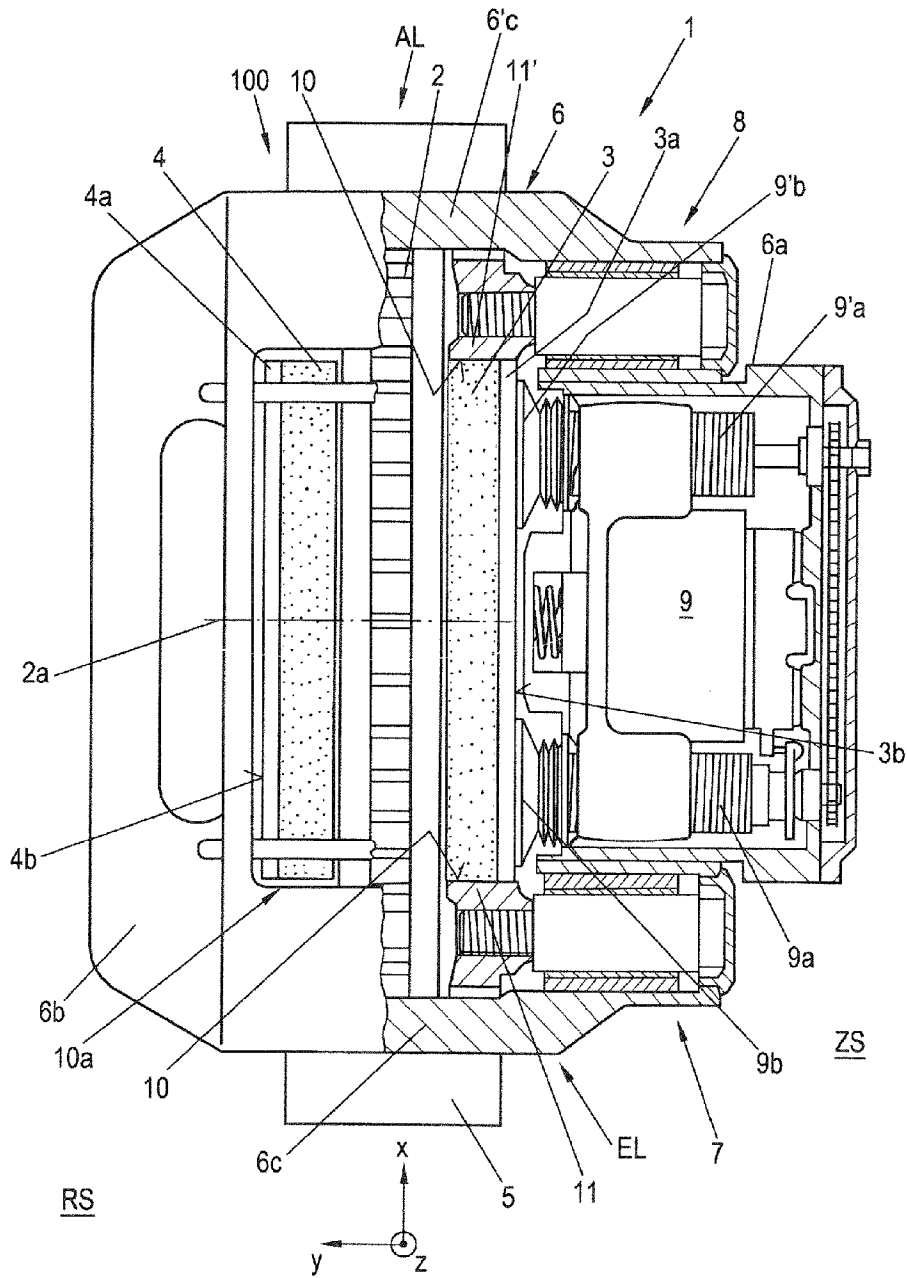
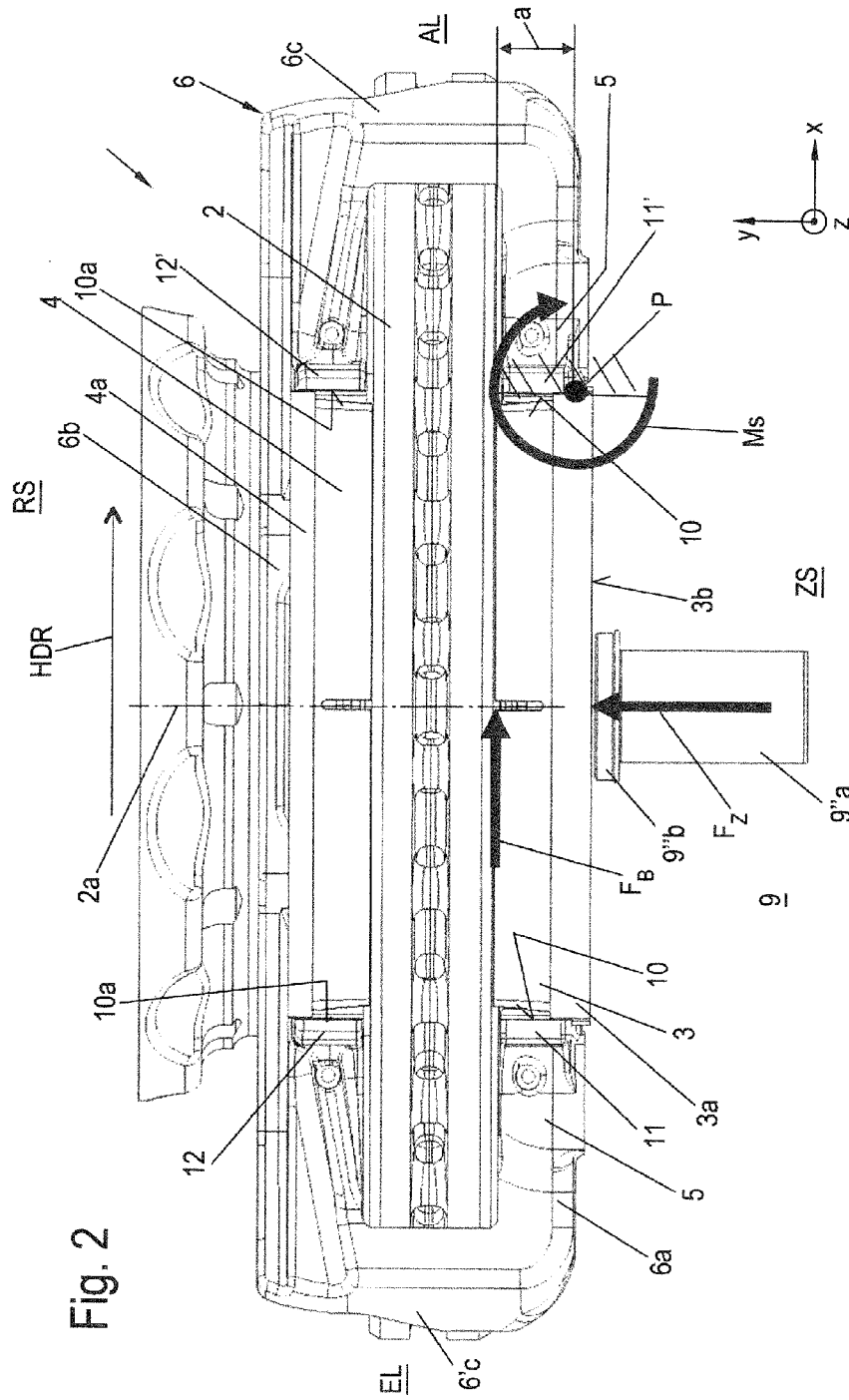


Fig. 1



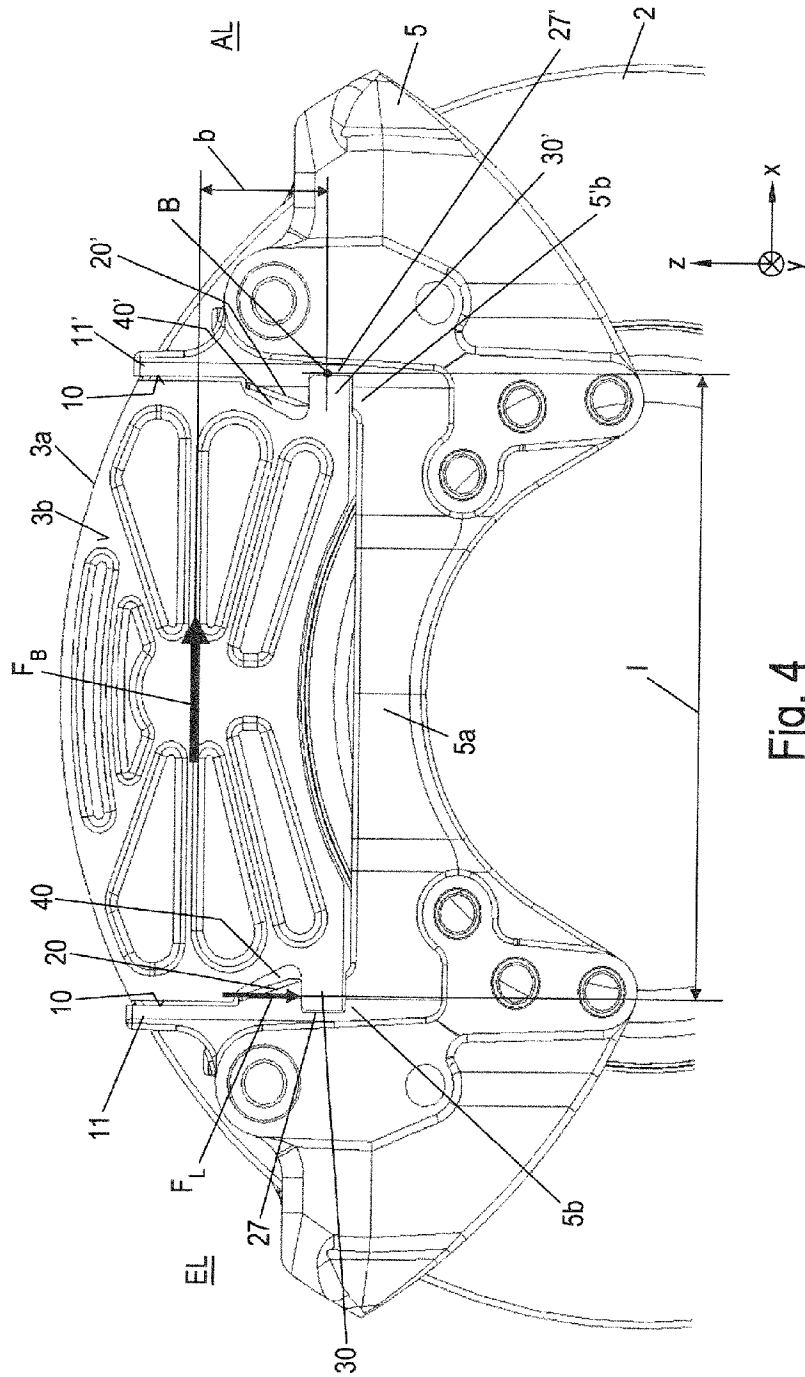


Fig. 4

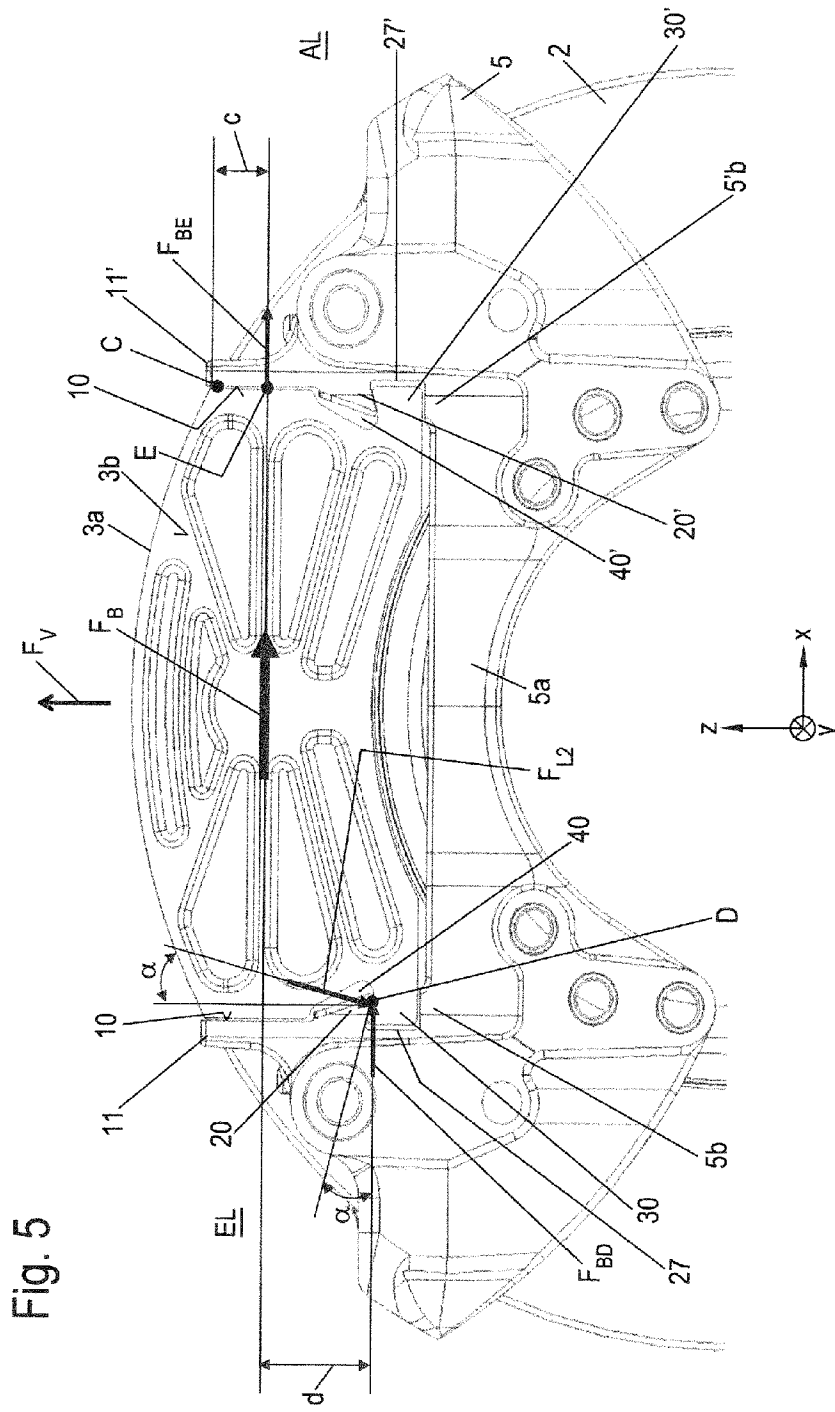


Fig. 5

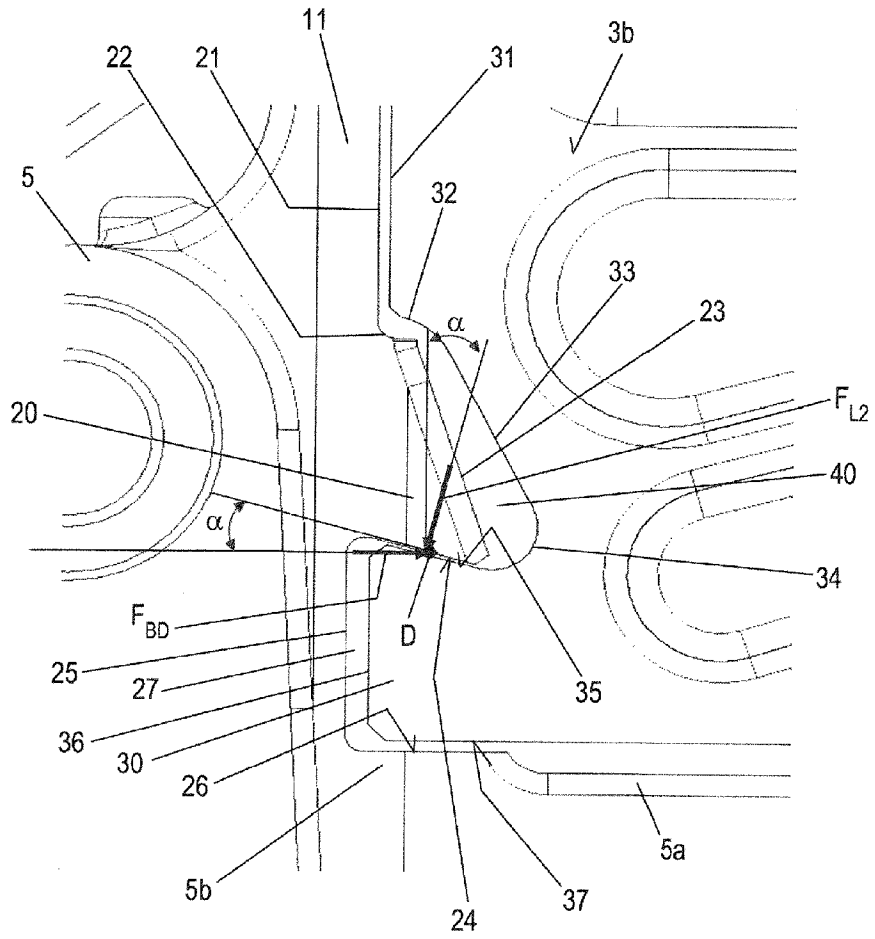
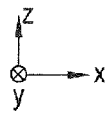


Fig. 6



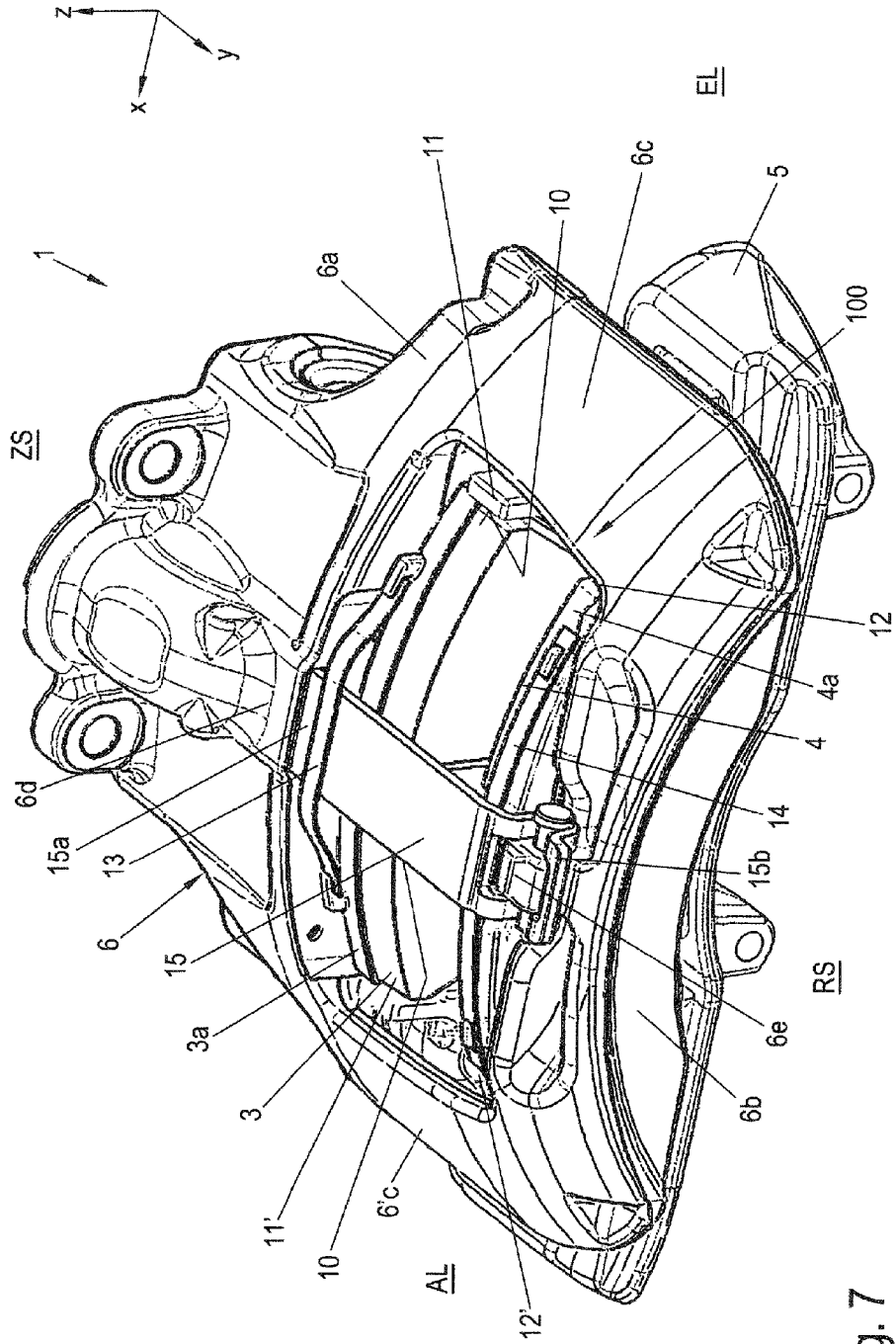


Fig. 7